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(54) **POWER RECEIVING DEVICE FOR WIRELESS CHARGING AND PORTABLE ELECTRONIC DEVICE HAVING THE SAME**

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H02J 7/02 (2006.01)
H02J 5/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H02J 7/025*** (2013.01); *H02J 5/005* (2013.01); *H02J 7/0044* (2013.01)

(58) **Field of Classification Search**
USPC 320/108, 139, 150
See application file for complete search history.

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(57) **ABSTRACT**

Disclosed herein are a power receiving device for wireless charging and a portable electronic device having the same. The power receiving device for wireless charging include a body having a receiving space formed therein; and a charging kit detachably received in the receiving space, and including a coil formed to receive power by magnetic coupling with a power supplying device and a charging circuit configured to charge a battery by electromotive force induced in the coil.

9 Claims, 7 Drawing Sheets

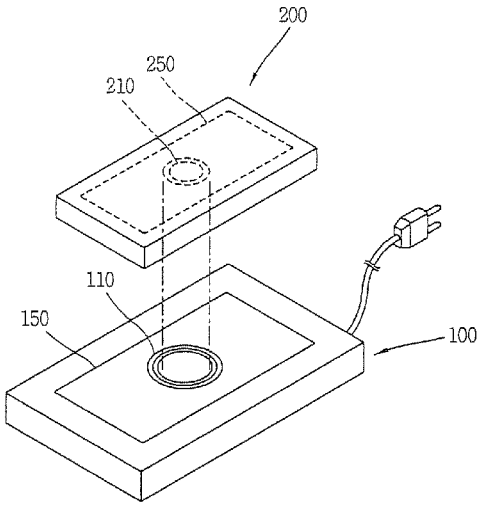

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FIG. 1

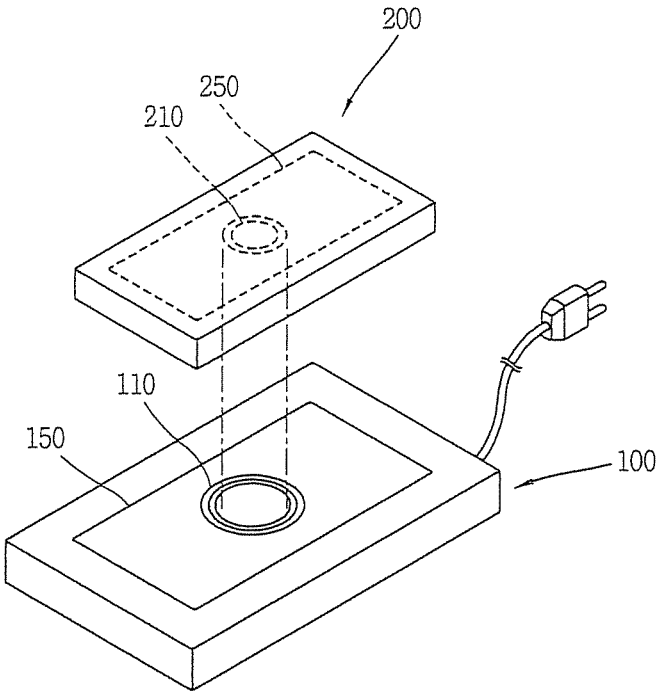


FIG. 2

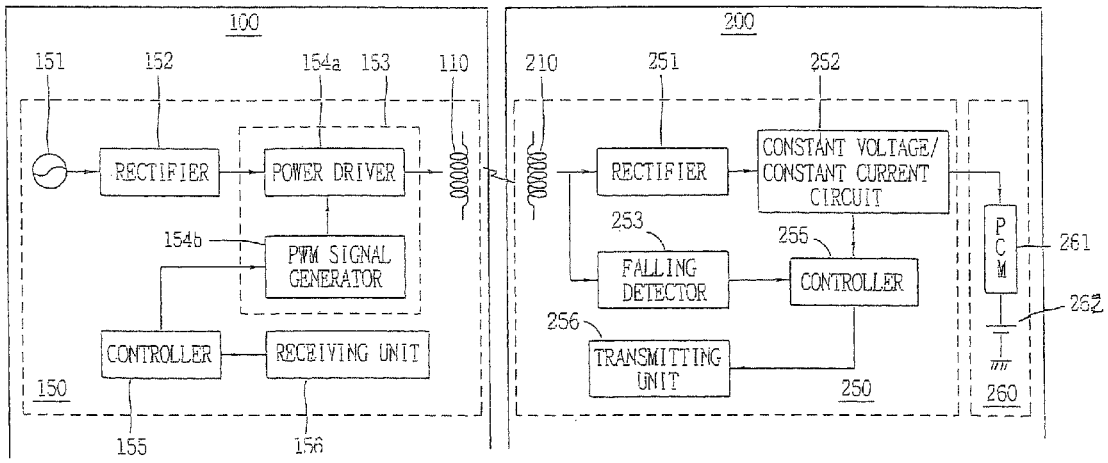

100
151
152
154a
153
110
RECTIFIER
POWER DRIVER
154b
PWM SIGNAL GENERATOR
CONTROLLER
RECEIVING UNIT
150
155
156
200
210
251
252
RECTIFIER
CONSTANT VOLTAGE/ CONSTANT CURRENT CIRCUIT
253
255
FALLING DETECTOR
CONTROLLER
256
TRANSMITTING UNIT
250
PCM
261
262
260

FIG. 3

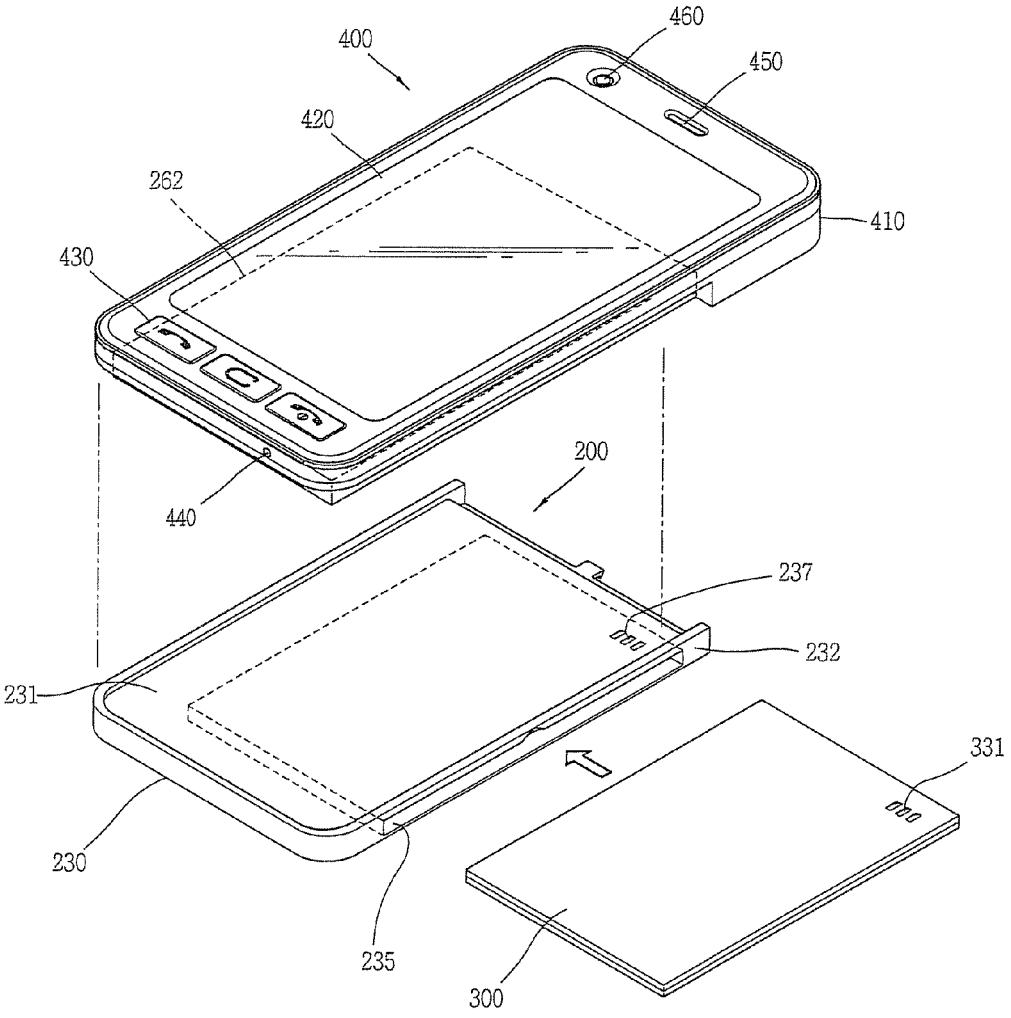


FIG. 4

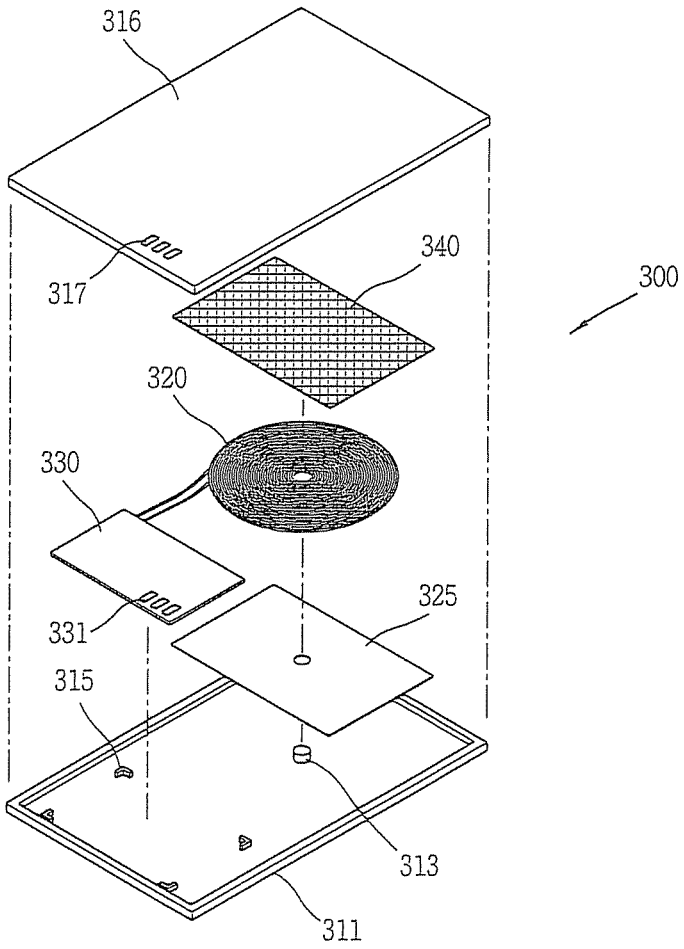


FIG. 5

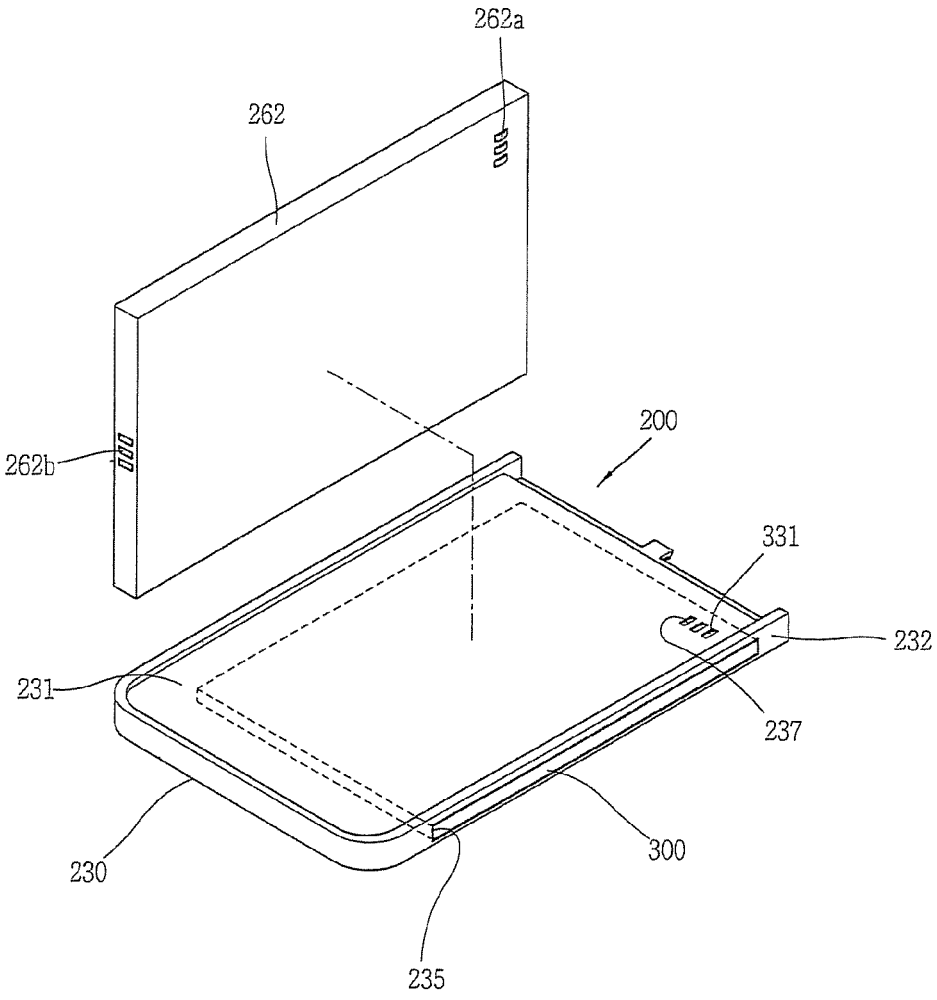


FIG. 6

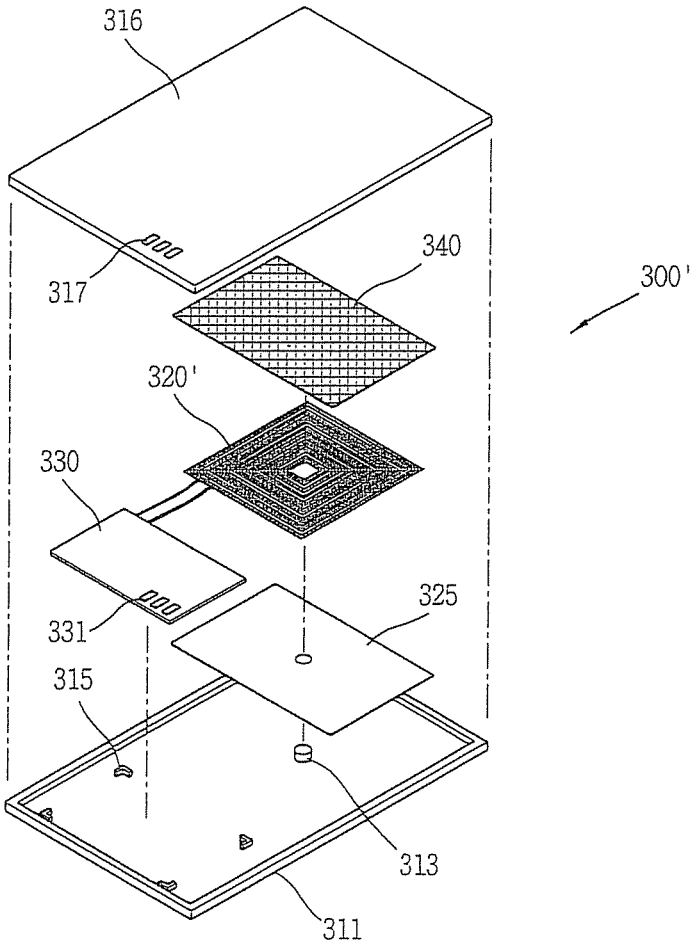
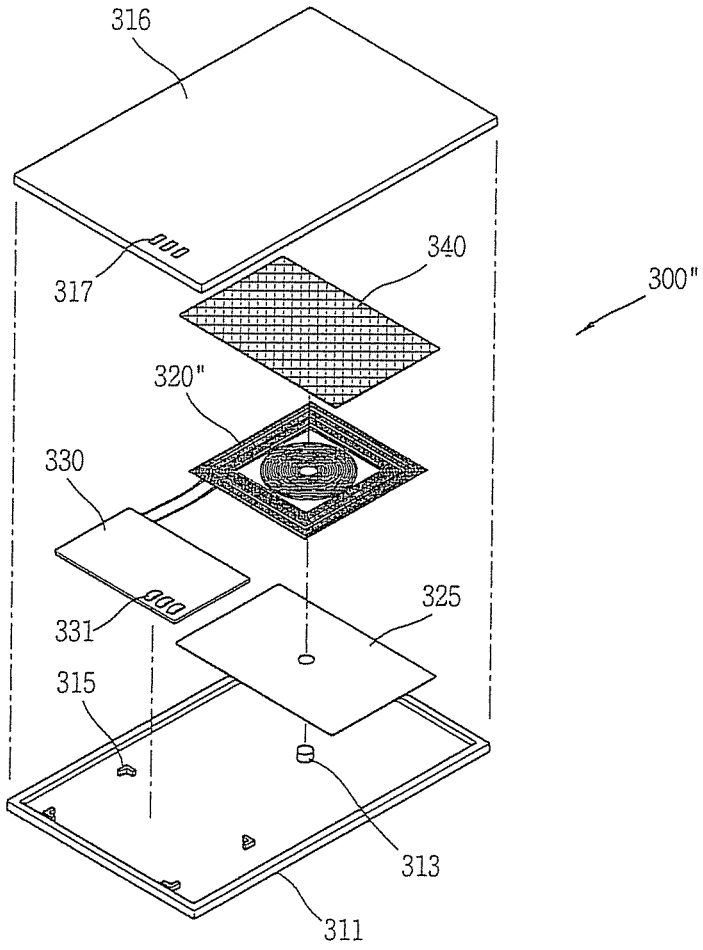


FIG. 7



POWER RECEIVING DEVICE FOR WIRELESS CHARGING AND PORTABLE ELECTRONIC DEVICE HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is the U.S. national stage of International Application PCT/KR2011/004109, filed Jun. 3, 2011, which claims the benefit of Korean Application No. 10-2010-0053437, filed Jun. 7, 2010 in the Korean Intellectual Property Office. The disclosures of both applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a power receiving device receiving power in a wireless charging system and a portable electronic device having the same.

2. Description of the Related Art

Generally, a portable electronic device such as a mobile communication terminal, a personal digital assistant (PDA), or the like, is mounted with a rechargeable battery. In order to charge the battery, a separate charging device, providing electrical energy to the battery of the portable electronic device using home commercial power, is required.

Typically, the charging device and the battery include separate contact terminals formed at outer portions thereof, respectively, such that the charging device and the battery are electrically connected to each other by connecting the contact terminals to each other. However, when the contact terminals as described above protrude externally, the contact terminals are not attractive in appearance. Also, the terminals may easily be dirtied or stained with external foreign materials, such that a contact state therebetween easily deteriorates. In addition, when the battery is short-circuited or exposed to moisture due to carelessness of a user, charged energy may be easily lost.

As an alternative to the above-mentioned contact type charging scheme, a non-contact type (wireless) charging system, charging the battery without contact between the terminals of each of the charging device and the battery, has been suggested.

SUMMARY OF THE INVENTION

Although not limited thereto, an object of the present invention is to provide a power receiving device for wireless charging capable of replacing a part for receiving power provided from a power supplying device for wireless charging, and a portable electronic device having the same.

While not limited thereto, according to an embodiment of the present invention, a power receiving device for wireless charging may comprise a body having a receiving space formed therein; and a charging kit detachably received in the receiving space and comprising a coil formed to receive power by magnetic coupling with a power supplying device and a charging circuit configured to charge a battery by electromotive force induced in the coil.

According to an aspect of the invention, the body may comprise a battery cover coupled with a portable electronic device which covers the battery mounted in the portable electronic device.

According to an aspect of the invention, the receiving space may be formed so that the charging kit is received through a side of the battery cover.

According to an aspect of the invention, the receiving space may comprise a surface in parallel with a main surface of the battery cover.

According to an aspect of the invention, the charging kit may further comprise a frame enclosing the coil and the charging circuit and forming an exterior.

According to an aspect of the invention, the coil may be formed to have any one of a substantially circular shape, a substantially rectangular shape, a substantially track shape, a substantially oval shape, and a combination thereof.

According to an aspect of the invention, the charging circuit may comprise a charging terminal connected to a first terminal of the battery.

According to an aspect of the invention, the charging kit may further comprise a shielding member disposed in the frame which blocks leakage of magnetic force of the coil.

According to an aspect of the invention, the frame may comprise first and second parts coupled with each other to form an internal space within which the coil and the charging circuit are disposed.

According to an aspect of the invention, the frame may further comprise a shaft which protrudes from at least one of the first and second parts to support the coil.

According to an aspect of the invention, the charging circuit may comprise a charging terminal formed to be connected to a terminal of the battery, and any one of the first and second part may comprise a terminal slot exposing the charging terminal.

According to an aspect of the invention, the body may comprise a portable electronic device within which the battery is mounted.

White not limited thereto, according to another embodiment of the present invention, a portable electronic device may comprise a body comprising a display and a battery supplying power to the display; and the power receiving device for wireless charging as described above which supplies the power to the battery.

According to an aspect of the invention, the body may further comprise a wireless communication module.

According to an aspect of the invention, the battery may comprise a first terminal connected to the power receiving device for wireless charging; and a second terminal connected to a terminal of the body.

With the power receiving device for wireless charging and the portable electronic device having the same according to embodiments of the present invention configured as described above, a portion of the power receiving device for wireless charging may be replaced as needed.

Furthermore, according to embodiments of the present invention configured as described above, the portion to be replaced may also be used in another power receiving device for wireless charging.

Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a schematic perspective view of a wireless charging system, according to an embodiment of the present invention;

FIG. **2** is an internal functional block diagram of the wireless charging system of FIG. **1**;

FIG. **3** is an exploded perspective view showing a power receiving device and a mobile communication terminal in which the power receiving device is mounted, according to an embodiment of the present invention;

FIG. **4** is an exploded perspective view of a charging kit according to an embodiment of the present invention;

FIG. **5** is an exploded perspective view showing a relationship between a battery and the power receiving device of FIG. **3**;

FIG. **6** is an exploded perspective view showing a charging kit according to another embodiment of the present invention; and

FIG. **7** is an exploded perspective view showing a charging kit according to still another embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Hereinafter, a power receiving device for wireless charging and a portable electronic device having the same according to embodiments of the present invention will be described in detail with reference to the accompanying drawings, in order to explain the present invention. The embodiments are described below in order to explain the present invention by referring to the figures. In the present specification, throughout the described embodiments of the present invention, similar components will be denoted by the same or similar reference numerals.

FIG. **1** is a schematic perspective view of a wireless charging system according to an embodiment of the present invention.

According to the embodiment shown in FIG. **1**, the wireless charging system is configured to comprise a power supplying device **100** and a power receiving device **200** which receives power from the power supplying device **100** without contact in order to charge a battery.

The power supplying device **100** is a device receiving electrical energy supplied from an external power supply to generate charging power to be supplied to the power receiving device **200**. The power supplying device **100** may be formed in a pad shape on which the power receiving device **200** may be easily seated thereon. As external power supplied to the power supplying unit **100**, alternating current (AC) power, including but not limited to American commercial power (60 Hz, 220V/100V), or direct current (DC) power may be used.

The power receiving device **200** may comprise a battery pack, or a portable electronic device, in which a battery is embedded. In another embodiment, the power receiving device **200** may be a portion of a portable electronic device connected to the battery or a member connected to the battery separately from the portable electronic device. Examples of the portable electronic device may include, but are not limited to, cellular phones, personal digital assistants (PDAs), MP3 players, or the like. The battery, which is a rechargeable battery cell, may comprise a lithium ion battery, a lithium polymer battery, or the like.

The power supplying device **100** and the power receiving device **200** may comprise a primary coil **110** and a secondary coil **210** corresponding to each other, respectively. The primary and secondary coils **110** and **210** are magnetically coupled with each other by induction coupling. Therefore, the secondary coil **210** is juxtaposed on the primary coil **110**, such that a magnetic field generated by the primary coil **110** induces a current in the secondary coil **210**.

The power supplying device **100** comprises a charging power supplying circuit **150** (see FIG. **2**) embedded therein in order to drive the primary coil **110** to generate the magnetic field. The power receiving device **200** comprises a charging circuit **250** (see FIG. **2**) embedded therein in order to charge the battery using electromotive force induced within the secondary coil **210**.

Hereinafter, referring to the embodiment shown in FIG. **2**, one possible detailed configuration of the charging power supplying circuit **150** and the charging circuit **250** will be described. FIG. **2** is an internal functional block diagram of the wireless charging system of FIG. **1**.

Referring to FIG. **2**, the charging power supplying circuit **150** embedded in the power supplying device **100** may be configured to comprise the primary coil **110**, a rectifier **152**, a driving circuit **153**, a controller **155**, and a wireless receiving module **156**.

The rectifier **152** rectifies an AC voltage from a commercial AC power supply **151** into a DC voltage and then transfers the DC voltage to the driving circuit **153**. The driving circuit **153** generates an AC voltage pulse having a high frequency equal to or larger than a commercial frequency, using the DC voltage rectified by the rectifier **152**, and applies the AC voltage pulse to the primary coil **110** to generate the magnetic field.

The driving circuit **153** may comprise a power driver **154***a* and a pulse width modulation (PWM) signal generator **154***b*. The power driver **154***a* may comprise a high frequency oscillating circuit which converts a predetermined level of DC voltage into an AC voltage having a high frequency equal to or larger than a commercial frequency, and a drive circuit which applies a pulse width modulated high frequency AC voltage pulse to the primary coil **110** to drive the primary coil **110**. The PWM signal generator **154***b* may modulate a pulse width of the high frequency AC voltage. Therefore, an output signal transmitted from an output terminal of the power driver **154***a* may become a high frequency AC voltage pulse. The high frequency AC voltage pulse may be a pulse train of which a pulse width may be controlled by the controller **155**. As the driving circuit **153** described above, for example, a switching mode power supply (SMPS) may be adopted.

The controller **155** controls a pulse width of the pulse width modulated high frequency AC voltage pulse based on information on a charged state of the battery, fed back through a wireless transmitting module **256** and the wireless receiving module **156**. For example, the controller **155** may change a driving mode of the primary coil **110** from a standby mode into a charging mode when a response signal fed back from the charging circuit **250** is a charging start signal. In addition, the controller **155** may change the driving mode of the primary coil **110** from the charging mode to a fully charged mode when it is judged that the battery is fully charged as a result of analyzing the information on the charged state fed back from the charging circuit **250**. Likewise, the controller **155** may maintain the driving mode of the primary coil **110** in the standby mode when a response signal fed back from the charging circuit **250** is not present. It will be recognized that yet other information and corresponding driving modes are possible.

The wireless receiving module **156** may comprise a receiving unit such as a demodulator, which demodulates a feedback response signal transmitted from the wireless transmitting module **256** of the charging circuit **250** as the primary coil **110** receives the feedback response signal, thereby reconstructing the information on the charged state of the battery **262**. The wireless receiving module **156** may in some embodiments also comprise an antenna (not shown) which receives the feedback response signal transmitted from the

wireless transmitting module **256** of the charging circuit **250**, separately from the primary coil **110**.

The charging power supplying circuit **150** described above may further comprise an over-current filter circuit which protects the circuit from an over-current, or a constant voltage circuit which maintains the DC voltage rectified by the rectifier at a predetermined level of voltage. The over-current filter circuit may be disposed between the commercial AC power supply **151** and the rectifier **152**, and the constant voltage circuit may be disposed between the rectifier **152** and the driving circuit **153**.

Next, the charging circuit **250**, which receives the power supplied from the charging power supplying circuit **150** to charge the battery **262**, will be described. This charging circuit **250** may be embedded within the power receiving device **200**.

The charging circuit **250** may comprise the secondary coil **210**, a rectifier **251**, a constant voltage/constant current circuit **252**, a falling detector **253**, a controller **255**, and the wireless transmitting module **256**.

The secondary coil **210** is magnetically coupled with the primary coil **110** to generate induced electromotive force. As described above, when a power signal applied to the primary coil **110** is the pulse width modulated signal, the induced electromotive force induced in the secondary coil **210** is also an AC voltage pulse train. In addition, an AC voltage pulse induced in the secondary coil **210** according to the driving mode of the primary coil **110** may also take any one of the standby mode, the charging mode, and the fully charged mode.

The rectifier **251** is connected to an output terminal of the secondary coil **210** and planarizes the AC voltage pulse induced by the secondary coil **210** to a predetermined level of DC voltage. The constant voltage/constant current circuit **252** generates a constant voltage and a constant current to be charged in the battery **262** using the predetermined level of DC voltage. More specifically, the constant voltage/constant current circuit **252** maintains a current constant mode at the time of an initial charged time of the battery **262** and then changes the constant current mode into a constant voltage mode when a charged voltage of the battery **262** is reached in a saturated state.

The falling detector **253** is a device detecting a descent time of the AC voltage pulse induced by the secondary coil **210**; in other words, a falling time. A falling detecting signal is transmitted to the controller **255**.

The controller **255**, which may be a kind of microprocessor, receives monitoring signals such as the falling detecting signal, a charged current, a charged voltage, and the like, and controls the constant voltage/constant current circuit **252** and the wireless transmitting module **256** based on the monitoring signal. For example, the controller **255** may recognize the descent time of the pulse based on the falling detecting signal input from the falling detector **253**, and synchronizes a transmission time of the feedback response signal to be transmitted to the charging power supplying circuit **150** with the descent time of the pulse. The controller **255** may monitor the charged current and the charged voltage of the battery **262**, and may temporally store the monitored value in an internal memory (not shown). The memory may store specification information (a product code, a rating, and the like) of the battery **262** as well as the information on the charged state of the battery **262** such as the monitored charged current and charged voltage therein.

In addition, the controller **255** may appropriately select the constant voltage mode or the constant current mode and change between the constant voltage mode and the constant current mode, according to the charged state of the battery **262**. The controller **255** may monitor whether an excessive voltage is applied to both ends of the constant voltage/constant current circuit **252**, and may generate an request signal for adjusting the charged power when the excessive voltage is applied to both ends of the constant voltage/constant current circuit **252**. This adjustment request signal may be fed back to the charging power supplying circuit **150** of the power supplying device **100** through the wireless transmitting module **256**.

The monitoring operation on the voltage at both ends of the constant voltage/constant current circuit **252** may be performed by measuring a voltage at a front end and a voltage at a rear end of the constant voltage/constant current circuit **252** and inspecting whether or not a difference between the front and rear voltages exceeds a reference voltage. The wireless transmitting module **256** may comprise a transmitting unit which demodulates a base band signal, such as the information on the charged state, when the secondary coil **210** transmits the feedback response signal (a charging start signal, a charged state signal, an adjustment request signal, or the like) to the charging power supplying circuit **150**, thereby generating the feedback response signal. The wireless transmitting module **256** may also comprise an antenna which transmits the feedback response signal to the charging power supplying circuit **150**, separately from the secondary coil **210**.

A protective circuit module (PCM) **261**, which prevents an over-voltage or an over-current from being applied to the battery **262**, may be disposed between the constant voltage/constant current circuit **252** and the battery **262**. The protective circuit module **261** and the battery **262** may constitute a battery unit **260**.

FIG. **3** is an exploded perspective view showing a power receiving device **200** and a mobile communication terminal **400** in which the power receiving device **200** is mounted, according to an embodiment of the present invention.

Referring to FIG. **3**, first, the portable electronic device may be a mobile communication terminal **400** comprising a wireless communication module. The mobile communication terminal **400** may be configured to comprise a body **410**, a display **420**, operation keys **430**, a microphone **440**, a speaker **450**, a camera **460**, and a battery **262**. The display **420** may comprise a touch layer capable of performing a touch input. Information inputted using the operation keys **430** may be outputted through the display **420** and the speaker **450**. An audio or other sound is received through the microphone **440**. Image information is received through the camera **460**.

The battery **262** supplies power required for an operation of the display **420**, or the like. The battery **262** may be mounted in the body **410** or separated from the body **410**, attaches through a rear surface of the body **410**. In order to access the battery **262** in embodiments where said battery is mounted in the body **410**, a battery cover **230** may be detachably coupled with the rear surface of the body **410**.

In the shown embodiment, a charging kit **300** is detachably received in the battery cover **230**. The battery cover **230** or the body **410** and the charging kit **300** constitute the power receiving device **200**.

The battery cover **230** may comprise a main surface **231** and a side surface **232**. In the side surface **232**, a receiving space **235** in which the charging kit **300** is received may be opened so as to be in communication with the outside. The charging kit **300** received in the receiving space **235** may be disposed in parallel with the main surface **231**. According to the above-mentioned configuration, although the charging kit **300** is inserted, an increase in a thickness of the main surface **231** may be minimized.

The charging kit **300** is a kit receiving power wirelessly supplied from the power supplying device **100** (see FIG. **1**) to charge the battery **262**.

Although an embodiment in which the charging kit **300** is received in the body which is the battery cover **230** has been described, the charging kit **300** may also be configured to be received in the body **410** of the mobile communication terminal **400**. In this case, the body of the power receiving device **200** may become the body **410** of the mobile communication terminal **400**. Further, the receiving space **235**, which is a space that may be exposed to the outside through the side of the body **410**, may be formed in the body **410**.

One embodiment of the above-mentioned charging kit **300** will be now described with reference to FIG. **4**, which is an exploded perspective view of a charging kit **300**.

Referring to FIG. **4**, the charging kit **300** may be configured to comprise frames **311** and **316**, a coil **320**, an adhesive member **325**, a charging circuit **330**, and a shielding member **340**.

The frames **311** and **316** are members forming an exterior of the charging kit **300**. The frames **311** and **316** may comprise a first part **311** and a second part **316** coupled with each other so as to form an internal space receiving the coil **320**, or the like, therein. The first part **311** may comprise a shaft **313** and a rib **315** protruding from an inner surface thereof. The second part **316** may comprise a terminal slot **317** opened therein.

The coil **320** is the secondary coil described by a reference numeral **210** in FIGS. **1** and **2**. The coil **320** is magnetically coupled with the primary coil **110** (see FIG. **1**) to induce electromotive force. The coil **320** may be wound in a substantially circular shape. The center of the coil **320** may comprise an opening part into which the shaft **313** is inserted.

The adhesive member **325** is disposed between the first part **311** and the coil **320** to adhere the coil **320** to the first part **311**. The adhesive member **325** may be, for example, a double-sided tape. The center of the adhesive member **325** may comprise an opening hole corresponding to the shaft **313**.

The charging circuit **330** is electrically connected to the coil **320** and allows the electromotive force induced in the coil **320** to be charged in the battery **262** connected through a charging terminal **331**. The charging circuit **330** may be fixed to the rib **315**.

The shielding member **340** may be disposed between the coil **320** and the second part **316**. The shielding member **340** serves to block a magnetic flux leaked from the coil **320** in a direction that deviates from the charging kit **300**. The shielding member **340** may comprise a magnetic material, which more effectively creates a magnetic path generated in the coil **320**, and an eddy current reducing member formed in a mesh form, which reduces discharge of the magnetic field to the outside. In such embodiments, the magnetic material serves to block the magnetic field from being discharged to the outside of the mobile communication terminal **400**, while simultaneously creating the magnetic path to improve a charging efficiency. A further portion of the magnetic field which escapes the magnetic material is blocked by the eddy current reducing member. To assist in this purpose, the magnetic material and the eddy current reducing member may comprise two plates which are stacked so that their main surfaces face each other.

FIG. **5** is an exploded perspective view showing a relationship between a battery **262** and the power receiving device **200** of FIG. **3**.

Referring to FIG. **5**, the battery **262** may comprise a first terminal **262***a* and a second terminal **262***b* that are exposed to the outside. The first terminal **262***a* may be connected to the charging terminal **331** of the power receiving device **200**, and the second terminal **262***b* may be connected to a terminal of the mobile communication terminal **400** (see FIG. **3**).

The power receiving device **200** comprises the body **230** in which the charging kit **300** is embedded as described above. In the shown embodiment, the body **230** is a battery cover coupled with the mobile communication terminal **400** so as to enclose the battery **262**. The a main surface **231** of the body **230** comprises an exposing part **237** which exposes the charging terminal **331**. The charging terminal **331** exposed to the outside through the exposing part **237** is connected to the first terminal **262***a* of the battery **262**.

According to the above-mentioned configuration, the power induced in the charging kit **300** by the power supplying device **100** (see FIG. **1**) is charged in the battery **262** through the charging terminal **331** and the first terminal **262***a*. The charged battery **262** supplies power to the mobile communication terminal **400** through the second terminal **262***b*.

Since the charging kit **300** may be separated from the body **230**, the charging kit **300** for one body **230** may also be used for another body. Therefore, when there is abnormality in the charging kit **300**, it is possible to replace only the charging kit **300** rather than the body **230**.

Further, it is also possible for one charging kit **300** to be used in various power receiving devices **200**. For example, one charging kit **300** may be used to charge the battery **262** of the mobile communication terminal **400** and may also be used to charge a battery of a portable camera.

FIG. **6** is an exploded perspective view showing a charging kit **300'** according to another embodiment of the present invention.

Referring to FIG. **6**, the charging kit **300'** is substantially the same as the charging kit **300** according to the embodiment of the present invention described in FIG. **4**, except that a coil **320'** is different from the coil **320**.

In the present embodiment, the coil **320'** is wound in a substantially rectangular shape. Since the coil **320'** having the rectangular shape may possess an area greater than the coil **320** having the circular shape, efficiency of magnetic coupling with the primary coil **110** (see FIG. **1**) is higher.

FIG. **7** is an exploded perspective view showing a charging kit **300"** according to still another embodiment of the present invention.

Referring to FIG. **7**, the charging kit **300"** is substantially the same as the charging kit **300** according to the embodiment of the present invention described above except that a coil **320"** is different from the coil **320**.

In the present embodiment, the coil **320"** has a complex form in which a coil having a circular shape is disposed in another coil having a rectangular shape. Since the coil **320"** having the complex form described above may secure an area wider than the coil **320** having the circular shape, efficiency may be improved. In addition, efficiency of the coil **320"** when slight misalignment with the primary coil **110** (see FIG. **1**) occurs may also be improved over the coil having the rectangular shape.

It will be further recognized that the coil is not limited to having the circular shape of **320**, the rectangular shape of **320'**, or the complex form of **320"**, but may also be wound in an oval shape, a track shape, or the like.

The power receiving device for wireless charging and the portable electronic device having the same as described above are not limited to the configuration and the operation scheme of the above-mentioned embodiments. It would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the

claims and their equivalents. The above-mentioned embodiments may also be variously modified through a selective combination of all or some thereof.

The invention claimed is:

1. A power receiving device for wireless charging comprising:

a body having a receiving recess formed at a side of the body and an exposing hole formed at a portion of the body which defines the receiving recess; and

a charging kit detachably mounted in the receiving recess, and comprising a coil formed to receive power by magnetic coupling with a power supplying device, a charging circuit configured to charge a battery by electromotive force induced in the coil and having a charging terminal configured to be contacted with a first terminal of the battery, and a frame having a closed space accommodating the coil and the charging circuit and a terminal slot configured to receive the charging terminal and disposed to correspond to the exposing hole.

2. The power receiving device for wireless charging of claim **1**, wherein the body comprises a battery cover coupled with a portable electronic device which covers the battery mounted in the portable electronic device,

wherein the battery cover includes, a main surface where the exposing hole is formed, a side surface where the entrance of the receiving recess is formed, and a hook configured to be coupled with the portable electronic device.

3. The power receiving device for wireless charging of claim **1**, wherein the coil is formed to have any one of a circular shape, a rectangular shape, a track shape, a oval shape, and a combination thereof.

4. The power receiving device for wireless charging of claim **1**, wherein the charging kit further comprises a shielding member disposed in the frame leakage of magnetic force of the coil.

5. The power receiving device for wireless charging of claim **1**, wherein the frame comprises first and second parts coupled with each other to form the closed space.

6. The power receiving device for wireless charging of claim **5**, wherein the frame further comprises a shaft which protrudes from at least one of the first part and the second part to support the coil.

7. A portable electronic device comprising:

a body comprising a display and a battery supplying power to the display; and

the power receiving device for wireless charging of claim **1** which supplies the power to the battery.

8. The portable electronic device of claim **7**, wherein the body further comprises a wireless communication module.

9. The portable electronic device of claim **7**, wherein the battery comprises:

a first terminal connected to the power receiving device for wireless charging; and

a second terminal connected to a power terminal of the body.

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